COMPUTER AIDED LEARNING FOR CHINESE PHONETICS

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Abstract

Computer aided learning have been implemented by lots of institutions and universities nowadays, due to the fast growing of information technology and the trends of moving towards paperless environment.

Computer Aided Learning for Chinese Phonetics is a learning package to assist students in the study of Chinese Phonetics. This package will provide the basic pronounce of Pinyin, which is a romanize system use in Chinese Phonetics and syllabus teaching in primary school. It also contains exercises, quizzes and games to help users make use what their learned.

Besides, as a different between learning packages in the market, I also included Chinese ancient scripture and poem as an additional syllabus to help user learn Chinese Phonetics from different sources.

This package will be implemented in 2 languages, English and Chinese. And for the Chinese version, there will have simplified Chinese and traditional Chinese version to choose by the user.

The development of this package is assisted by multimedia tool to make it a more attractive, efficient and effective during learning process. It is hope that development this package will assist all students to learn Chinese Phonetics with interest.

Table of Contents

List of Figures

List of Tables

Chapter 1 Project Introduction

1.1 Project Overview

Computer Aided Learning (CAL) means using the computer as a learning tool to assist students in their study. According to Oxford Advanced Learner English-Chinese Dictionary, phonetics mean study and science of speech sounds and the symbols used to represent them.

Therefore CAL for Chinese Phonetics (CALCP) is developed to help people to learn Chinese Phonetic using computer technology. This system is integrated with multimedia techniques like text, audio, animation and video displays, which make the learning process more interesting, effective and efficient. Besides, an attractive and user-friendly interface is designed for the system, in order to attract attention and interest from the users.

The system includes pronunciation, description of Pinyin pronunciation, example word and sentences, which is presented by interesting graphics, pictures and animation together with the sound. In addition, it also provides exercises and quizzes for user to test their understanding and helps them refresh their memory after learning. Besides, the system can record the pronunciation by user and playback to helps them to know how exactly they had pronounced the word.

CALCP provides pupils with a change of style on learning, which moves from normal study to virtual study. By providing animation of graphics together with sound effect, instead of just hearing and memorize from the teachers, not only motivates pupils to learn and regain their interest, but also makes the learning process more efficient, effective and successful. In conclusion, this system will improve the learning curve of pupils through a series of self-guided and easy-to-follow lessons.

1.2 Project Objectives

The main objective of this project is to build a system as a learning tool, that can helps users to learn Chinese Phonetics in more interesting way, and make the learning process more efficient and effective. This project will use techniques in multimedia for example text, audio, animation and video displaying together with interactive teaching-learning environment via computer to achieve the above objective.

Beside, the project also using to attract students' interesting in learning Chinese Phonetics by using multimedia techniques in the system. It also gives an opportunity for pupils to explore to multimedia computer environment, and the power of computer based learning.

Other objectives are as follow:

1. To help school's teachers and home's parents to teach their pupils or children Chinese Phonetics in much more attractive and effective than books.

2. Enhance the power of personal computer in computer-based learning and make use of multimedia technology effectively in real world.

1.3 Project Scope

This system covers the phonetic teach in primary school. It is designed for students from primary school and teacher who teaches in this level. Besides, the system is suitable for someone just start learning Chinese language, which want to pronounce Chinese words in the beginning level.

This system has 6 modules; they are Pinyin pronunciation module, word pronunciation module, exercise and quiz module, game module, and performance module.

i. *Pinyin Pronunciation module* provides beginning lesson for basic pinyin pronunciation which is a romanized system for Chinese pronunciation. It displays text, pictures, sounds and animation to help students to learn basic pinyin pronunciation.

ii. *Word Pronunciation module* contains the intermediate lesson to help students to pronounce a Chinese word. It also used text, pictures, sounds and animation in the lesson.

iii. *Exercise and Quiz module* provides exercise to student, which enhance their understanding of the lesson.

iv. *Game module* enables students to test their understanding to the lesson and used to get some fun with the phonetics!

v. *Performance module* shows the results in exercise and quizzes done by the login user in table and graphically.

Since most of the users of the system are students from primary school, user-friendly design is the main emphasis in the development.

1.4 Project Schedule

Project scheduling involves separates the total work in a project into separate activities and judging the time required to complete these activities. Some of these activities are carried out in parallel.

Project schedule helps us to plan the work and works the plan in order to ensure completion of a system in time. Below is a schedule of the project in Gantt chart, which shows the activities and their duration.

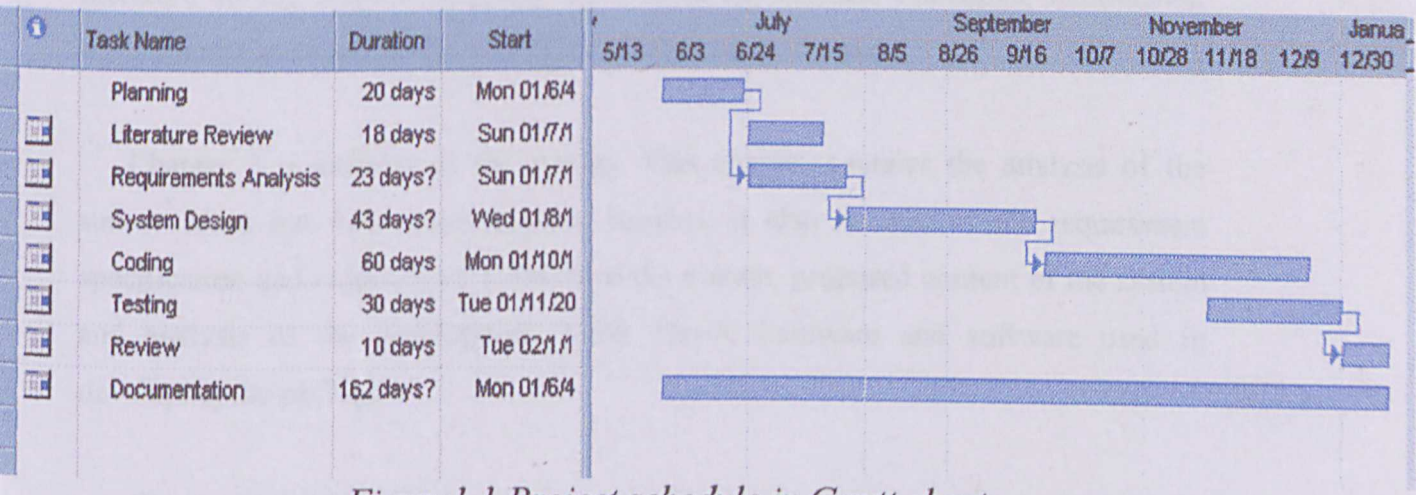

Figure1.1 Project schedule in Gantt chart

1.5 Summary

Documentation for this project consists of five chapters:

Chapter 1 is an introduction of the project. In this chapter, it gives a brief overview of the project, objectives of the project to be achieved, scope of project to be implemented and schedule of the project. The last part of this chapter is a summary of the documentation.

Chapter 2 is regards literature survey of the project. Library search and Internet search are the methods used to get relevant information for the project. Areas of literature survey include computer-aided learning, Chinese Phonetics, multimedia, development tools and reviews of other educational packages.

Chapter 3 is analysis of the system. This chapter contains the analysis of the survey taken out from questionnaire. Besides, it also documents the requirement specification and requirement analysis of the system, proposed content of the system and analysis of the development tools. Desire hardware and software used in developing the package.

Chapter 4 is about system design. It shows the system architecture, database design, process design in a data flow diagram, user interface design and the expected outcome of the system.

Chapter 2 Literature Review

2.1 Computer Aided Learning (CAL)

2.1.1 Introduction

The computer offers powerful features for facilitating learning, such as tutor-like interaction with the learner. Computer Aided Learning (CAL) refers to using the computer as a learning resource to assists students in the totality of their tasks.

Professor Sidney L. Pressey of Ohio State University developed the earliest "teaching" devices in the 1920's, which designed primarily to test the students with teaching only secondary interest. A good CAL does not just happen, but authors make it. While produce CAL we should consider:

- Subject matter presentation
- Interface dialogue between computer and learner
- Smoother communication between learner and computer
- Monitoring learner's understanding
- Motivating learner
- Sequencing the flow of instruction
- Designing screen display
- Programming the computer
- Evaluating the lesson.

There are 5 major categories of CAL as following:

i. *Drill and practice* are lessons that provide exercises of material already learned, in order to strengthen or maintain rote knowledge. Drill and practice involved any exercise, physical or mental, that is performed regularly and with constant repetition. It is often associated with rote-memory learning. Its purpose is to prepare learners on lower-level skills more readily to perform some higher-level complex skill.

ii. *Problem solving* presents situations or problems on the computer that are solved through a process logical deduction, synthesis and implementation.

iii. *Tutorials* seek to place the computer in the role of a tutor, one that carries the full instructional burden of guiding a student to the achievement of a specified set of objectives.

iv. *Simulation* creates an artificial, interactive environment that model a specific real or a specific fantasy environment. Such as managing the care of a sick patient or finding a faulty part in an electronic circuit. Success in the simulation task requires the application and synthesis of knowledge and the integration of new knowledge with old knowledge.

v. *Game* allow student to interact with instructions materials in a motivationally stimulating game forest. "Competitive" feature in it is the ability to promote a high-level of student motivation. Success in a game may require only rote knowledge or it may involve the application and extension of knowledge.

2.1.2 Advantages of Computer-Based Learning

i. Interactive, unlike books, videotapes, radios and televisions, the user can determine what the next move or get what they want. It requires active and motor involvement. It is not a passive exercise. Even if the choice is limited and the program merely provides the illusion of freedom, it still gives children a sense of control.

ii. Computer is fun and interesting. People love to respond to challenges, love to make things happen. The computer games industry has grown rich on that basic axiom. By coupling education to games of challenges, computer aided learning become fun and interesting.

iii. Computers have infinite patience. It does not concern the user's response are very slow or often make mistakes. It never gets tired or cranky.

iv. The computer can explain concepts in more interesting and understandable manner by means of animated material.

v. Whereas it is very difficult to hide things in a book, it becomes possible to hide things in a program, which become apparent only on occasion. A book on rereading holds few surprises. In contrast, a computer program can be full of surprises.

vi. The ability to simulate complex situations such as chemical reactions, ecosystems, and demographics or economic changes is a particularly powerful reason for using computer in education. Training pilots, managers, chemical engineers, i.e. any profession or activity world could be very costly when a mistake was made in the real world. Therefore, is best served by learning on a computer, which simulates the real-like situations.

vii. The computer allows 'real time' that is instant responses or allows instant communication. Every constructed respond is judged immediately and accurately. Users never wonder whether his or her response is correct or not.

Therefore, it is possible to develop a good system or program as a learning tool or package. So a good learning system will be friendly, entertaining, specific and meets requirement and needs of the user.

2.1.3 Disadvantages of Computer-Based Learning

i. CAL causes less direct human-to-human interaction. Since students could learn a course through the course materials and exercises prepared in the CAL packages, these will be less time spent for attending lectures and tutorials sessions. The communication shifted from lecture-students to lecture-computer and student-computer.

ii. CAL has limited system scope. Usually a CAL package is dedicated for a small scope. It is not feasible to develop a system that teaches all courses. This is because it needs much more effort and time to develop and different courses have its own effective teaching methods.

iii. CAL packages need computer system to operate. If no computer system is available, then no CAL packages are available. Currently not every family in Malaysia has computer especially in urban area.

2.2 Multimedia

The integration of multimedia technology into the communication environment has the potential to transform an audience from passive to active participants in a media-rich learning process. It makes the communication more effectively and even creates applications that would not be possible without sound and motion.

2.2.1 Introduction

Multimedia is a field concerned with the computer-controlled integration of various forms of media. Vaughan (1994) has been described multimedia as "any combination of text, graphics art, sound, animation and video deliver to you by computer or other electronic devices".

Text is one of the most widely used multimedia building blocks. The intensity of text usage depends greatly on purpose of the program. The text can always be displayed in different forms for different purpose, such as adding title buttons, bullets, paragraph and scrolling text.

As ancient Chinese saying states that a picture is worth a thousands words. People often learn and retain more information from pictures than other forms of information. The integration of graphics into a multimedia application includes the elements background, photo, three dimension pictures, charts, drawing and buttons.

Sound is one of the components of multimedia that can enhance the application by appealing to auditory learners. There are various forms of sounds such as special effect, narration, audio tracks from analogue or digital source, background music of musical performance and background or ambient sound.

Video usually is recording of live action. One can typically use video from three sources that are digital video stored in the files, the hard disk or on compact disk, video disk or video tape.

Moving image or animation is like a film and video. Animation displays a series of slightly different images in rapid succession and giving the illusion of motion. However animation is usually based on drawing.

It is generally agreed that most people retain about 20% of why they hear; 40% of what they see and hear; and 75% of what they hear, see and do. Experienced communications know that audiences have little interact in rote memorization and exclusively text-based learning [Villamil-Casanova, 1956]

2.2.2 Advantages of Multimedia

Benefits of multimedia as follow:

i. Multimedia mirrors the way in which human mind thinks, learns and remembers by moving easily from words to images to sounds, stepping along the way for interpretation, analysis and in-depth exploration.

ii. The combination of media elements in multimedia lesson enables trainees to learn more spontaneously and naturally, using whatever sensory modes they prefer. For example, some people learn best by seeing, others learn best by seeing and hearing, still others learn best through manipulation or kin aesthetic (tactile) exercises.

iii. Combining media elements with well-designed, interactive exercises enables learners to extend their experience to discover on their own, so that they are no longer passive while information is "fed" to them. Additionally programs may be designed to include immediate feedback in order to clarify misconceptions before trainee, become confused and to provide direct reinforcement for correct responses.

iv. While students may only raise their hands to ask question so many times, many multimedia programs (expect system) are designed allow learners to pause, branch, or stop for further remediation, exploration, or enhancement opportunities; these interactive qualities encourage non-linear thinking.

v. By combining words with pictures, graphics and audio, multimedia programs enable people with varying levels of literacy and math skills to learn by using sight, hearing and touch. Evidence suggests that using man segments as context for trainees significantly ends in reading comprehension.

vi. With a multimedia program as assistant, trainers can provide individualized attention.

2.2.3 Disadvantages of Multimedia

However, multimedia has a few disadvantages:

i. Need high processor speed, memory, disk space and data throughput.

ii. Those elements like sound, images or animation and video need higher bandwidth than text files because of the size.

2.3 Chinese Phonetics

According to Oxford Advanced Learner English-Chinese Dictionary, phonetics mean study and science of speech sounds and the symbols used to represent them.

In Chinese Phonetics, there was a romanize system call 'Pinyin' use to represent the sound and tone in each word. Pinyin was adopted in the 1950's and commonly used on street signs and storefronts in cities of China.

Unlike English, Chinese is a tonal language: each character, when pronounced, has one of four distinct tones. The tones and their markings are:

i. First tone: high and level
ii. Second tone: a rising tone
iii. Third tone: the tone dips then rises
iv. Fourth tone: a sharp falling tone

Pinyin consists of A-Z (except V) letter with each of them has their own sound pronounce. We can divide them into consonants, vowels and diphthongs. Each of them is describe below:

i. ***Consonants:***

All other consonants are pronounced much as in English, with the exception of **v**, which does not occur in Chinese. Example some consonant use in Pinyin:

c: like the **ts** of **cats**

q: like the **ch** of **ch**ip

r: like English **r**, but with the tip of the tongue turned up and back to touch the roof of the mouth, so that it sounds something like the **s** in pleasure.

x: most closely resembles a **sh** sound in English

y: before the letter u and i, y is not pronounced. Elsewhere, sounds like the **y** in **y**ard.

zh: like **j** in **j**acket

ii. Vowels:

a: as in father

e: as in hey

i: as in see

o: like **aw** in **saw**

u: like **oo** in **spoon**

ü: similar to German u or u in French "lune"; round your lips and try to pronounce the short u in the word cute

iii. ***Diphthongs:***

In compound vowels (diphthongs and triphtongs) the pronunciation starts from one vowel and "glides" to or towards another vowel; e.g. **i**, **ia**, **iao**. Some of the examples at below:

ai: as in cry

ao: as in now

ei: as in prey

ia: sounds like i-a, spoken rapidly

ie: sounds like i-e, spoken rapidly

iu: sounds like i-u, spoken rapidly

ou: as in oh

ua: similar to the sound wa

uai: similar to the sound wa+i, spoken rapidly

ue: a combination of ooh and short e, as in bed spoken rapidly

iong: like the ung in the German name Jung

2.4 Project Development Methodology

2.4.1 Waterfall Life Cycle

In developing a system, it is going through a process called life cycle. Waterfall model is a structured as a cascade of phases, when the output of one phase constitutes the input to the next one. Each phase, in turn, is structured as a set of activities that must be executed by different people concurrently.

Waterfall life cycle model comprises the following phases as show in figure 2.1:

1. Requirements Analysis

The purpose of this phase is to identify and document the exact requirements for the system. The specifier must state what qualities the application must exhibit, not how much qualities are achieved by design and implementation.

2. Design Specification

The purpose of the design is to specify a particular software system that will meet the stated requirements. It involved decomposing the system into 1 module and documented what each module is intended to do together with the relationships among the modules.

3 Coding and Module Testing

This is the phase that produces the actual code that will be delivered to the user as the running systems. The output of this phase is an implemented and tested collection of modules. Module testing is carried out to ensure the quality of the module.

4 Integration and System Testing

In this phase, all the modules that have been developed before and tested individually are put together integrated and tested as a whole system. The purpose of this phase is to test the system under realistic conditions, but with understanding and forgiving users. It is also called alpha testing.

5 Delivery and Maintenance

Once the system passes all the tests, it is delivered to the user and enters the maintenance phase. The purpose of this phase is to perform a kind of controlled experiment to determine; on the basis of feedback from users whether any changes are necessary prior to the official release. This kind of system testing done by selected users is called beta testing.

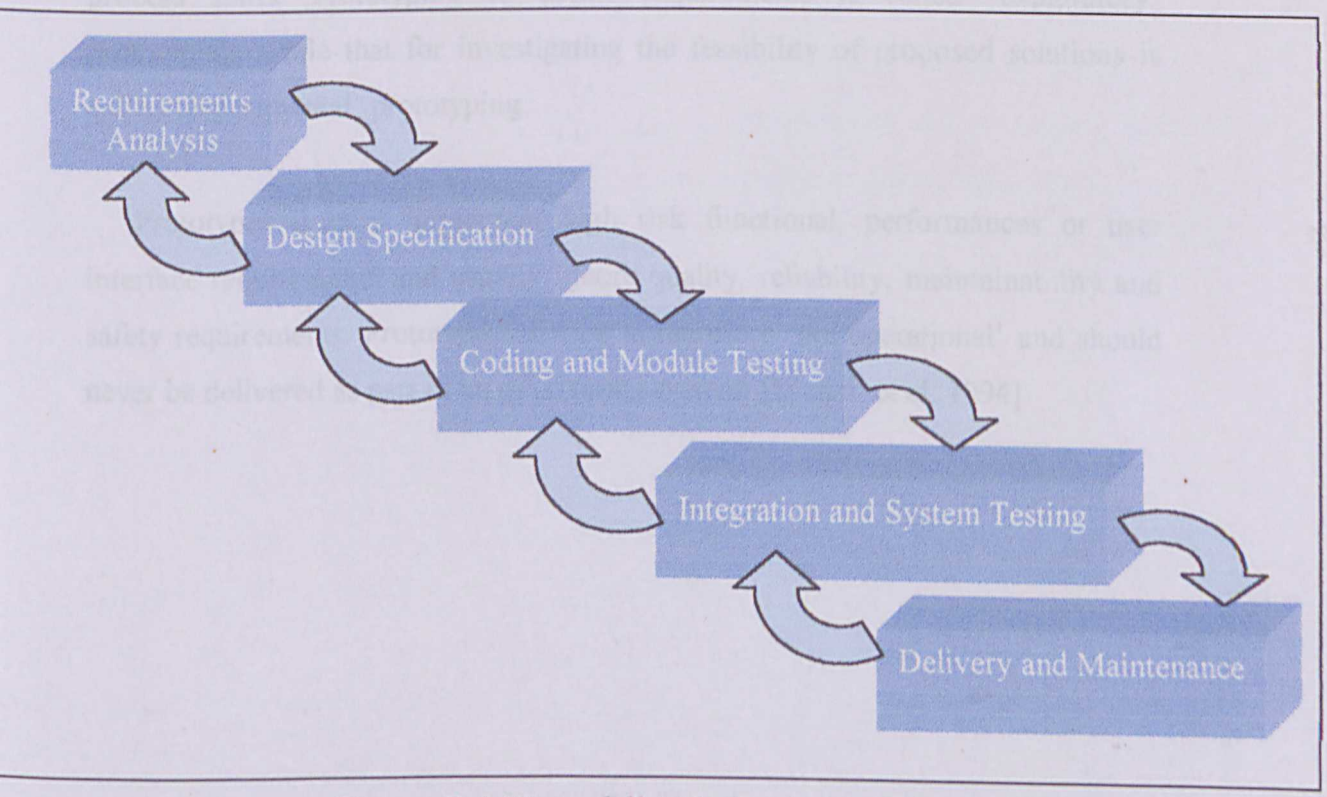

Figure 2.1 Waterfall Life Cycle Model

2.4.2 Prototyping

The use of prototypes to test user reaction and design ideas is common to many engineering disciplines. A software prototype implements selected aspects of proposed software so that tests, the most direct kind of verification, can be carried out.

Prototyping is the process of building prototypes. Prototyping within a single phase is a useful means of reducing the risk in a project through practical experience. The output of a prototyping exercise is the knowledge that is gained from implementing or using the prototype software.

The objective of the prototyping activity should be clearly stated before the process starts. Prototyping to define requirements is called 'exploratory' prototyping, while that for investigating the feasibility of proposed solutions is called 'experimental' prototyping.

Prototypes usually implement high risk functional, performances or user interface requirements and usually ignore quality, reliability, maintainability and safety requirements. Prototype software is therefore 'pre-operational' and should never be delivered as part of an operational system. [Mazza, et al. 1994]

2.4.3 Summary of Methodology

Table 2.1 Summary of Methodology

Model	Advantages	Disadvantages
Waterfall Model	~ Represent basic engineering practice specification. ~ Enable user to know their requirements.	~ No available for testing. ~ Assume that all will go well throughout project.
Prototyping	~ Increase creativity. ~ Accelerate several phases.	~ Difficult to manage prototyping as a project within the larger system effort. ~ May adopt a prototype as a completed system when in fact inadequate and was never intended to serve as a finished system

2.5 Learning Package Review

Several learning packages had been reviewed as references, in order to learn their benefits from them and aware of their mistake and disadvantages. From the review will enable me to develop a good learning package as expected by the users. There are 4 learning packaged I had review.

2.5.1 Language Learning: Chinese for Beginner

Chinese for the Beginner is a comprehensive language learning system tailored to meet the needs of the novice. There are no phrases to memorize or verbs to conjugate. The language is absorbed gradually through a series of self-guided and easy-to-follow lessons.

The lessons are in English and include basic pronunciation of four basic tones in Chinese as beginning lesson for the beginner. It will pronounce the Chinese meaning and show the Chinese word each time users point and click the mouse over the English word.

The lessons consist of phrase and words use everyday such as traveling, asking about weather or asking about direction. Besides, this software also consists record and playback features to help user to record what they pronounce and playback to let user know how they have pronounced.

But, this learning package doesn't have exercise or quizzes and it is lack of animation.

2.5.2 Language Learning: Everyday Chinese

Everyday Chinese is a self-paced language learning program, designed to make learning Chinese effortless. Simply points, clicks, listen and repeat what user has heard from a native speaker. It is almost same with the Language Learning: Beginner Chinese because two of them came from same publisher, Laser Publishing Group.

The different between is Everyday Chinese is easier to navigate and find what user what to learn, such as if user doesn't know how to pronounce '*ba*', user can go to the word drill '*B*' to find out. Besides, this software also consists of record and playback features to help user to record what they pronounce and playback to let user know how they have pronounced.

Also, this learning package doesn't have exercise or quizzes and it is lack of animation.

2.5.3 Learning Chinese by Story

Learning Chinese by story is software that helps users to learn Chinese by hearing story. This learning package is quite simple. It just has two sections. The first section consists of knowledge in Chinese Phonetics, which the program will read it out.

The second section is a story teller which read the story out with correct pronunciation. The user will choose a story and the program will display the story and read it out.

Learning Chinese by story have beautiful graphics but it is very confused to use because of not user-friendly interface and it cannot record and playback what user pronounce. Besides, it doesn't have exercise and quiz also.

2.5.4 Chinese Character Tutor

Chinese Character Tutor is a tutorial system designed to help students of Chinese in learning to read and write the characters used in written Chinese. The 600 characters in this program are derived from the revised list of 1375 Basic Characters currently in common use in the People's Republic of China.

The program functions both as a resource of information on the sound, composition and meaning of 600 characters, and as a tutorial guide to self-study of the Mandarin language in general.

The Test modules will challenge user's reading and listening ability in a series of graduated steps. Magic Squares tests user with the sound of a single character. The Shuffle Test requires user to type the pinyin of a given character, including the correct tones. The Tone Tester in purely a listening test, which gives user the choice of supplying correct tones for either mono or disyllabic words. Confident listeners may wish to try the 'Timed Test', which puts a limit on the response time for a given number of words.

Chinese Character Tutor also has very nice music background and have online help. But Chinese Character Tutor are lack of user performance analysis and doesn't have save function, which user have to start again every time run this program.

2.5.5 Summary of Reviewed Learning Package

From the review, it is noted that the most important characteristic for a learning package is to have a user-friendly interface, so that, user can handle it easily. Secondly, it should be interacted with multimedia techniques (graphics, animation, video, sound and text) in order to attract users' interest and make the learning process more interesting. Thirdly, the speed of retrieval data should be as fast as possible, so that user will not fell frustrated waiting for the system to load on information.

In addition, the package should be as comprehensive as possible, which comprises all the resources that are needed by users in the learning process. Finally, the package should also provide save function facilities. Thus, if any user wants to start from last lessons he learned, he could be easily found it.

Table 2.2 Summary of the reviewed learning package

Learning Package	Advantages	Limitation
Language Learning: Chinese for Beginner	~ Easy to navigate between lessons ~ Can record and playback	~ Lack of animation ~ No quizzes or exercises
Language Learning: Everyday Chinese	~ Ease to use ~ Enable user to learn correct pronunciation ~ Can record and playback	~ Lack of animation ~ No quizzes or exercises
Learning Chinese by story	~ Provide interesting stories ~ Beautiful graphics	~ Not easy to use (confusing) ~ No record and playback ~ No exercises and quizzes
Chinese Character Tutor	~ Very nice music background ~ Exercises and quizzes ~ Easy to use ~ Online help ~ Search Function	~ No save function ~ Lack of user performance analysis

2.6 Development Tools

2.6.1 Programming Tools

1. Visual Basic 6.0

Visual Basic is an event driven programmers language, where the code is executed as a responds to an event. For example, while open button is pressed, an open file dialog box is displayed. It also is a usual tool for multimedia. It allows loading a picture of graphics, generating animation image, play sound and activating video program such as Flash. Besides, Visual Basic also allows access various of database example ODBC, DAO and ADO.

In addition, we can use Visual Basic to write a Windows program easily and fast. Graphical user interface of Visual Basic makes it as an ease-programming tool. Add in Manager of it also provides various functions or tasks to complete a program. Finally, it enables programmers compile an executable program into setup disks.

2. C programming language

C programming language is a structure program language. It is a discipline approach to writing programs that are clear, demonstrably correct and easy to modify. It is portable where programs can run in many different computers. However, it requires technical skill in programming and is quite a difficult programming language.

Table 2.3 Summary of Programming Tools Features

Programming Language	Features
Visual Basic 6.0	~ Event driven programming language ~ Usual multimedia tool ~ Access of various database ~ Windows program ability ~ Graphics user interface ~ Ease programming tool ~ Allows program to be compiled into setup disks
C programming	~ Structured programming language ~ Portable language ~ Difficult programming language

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2.6.2 Database Tools

1. Microsoft Access 2000

Microsoft Access 2000 provides relational database power to gibe information to make better decisions. It can automatically builds tables, queries, forms and report from more than 20 types of full-featured templates, giving up the option to further customize them to suit your needs. Besides, if also automatically identifies the relationships in constructed data, such as a flat-file database and the re-organizes the information into a relational database.

In addition, it consists of an image control that provides a simple way to include graphical information on forms or reports, and improves the display performance of the images. Its compilation and better data manipulation technology result in quicker response and faster data operations. It also enables storage and retrieves data by Visual Basic.

The cue cards provide step-by-step instructions right alongside the task we are working on. It is like having our own tutor. Besides, it also helps us make the most of our past investments with direct support for Microsoft FoxPro, Microsoft SQL Server 7, dBase, Paradox and other popular tile formats. Furthermore, it provides password for accessing a particular databases as security purpose.

2. Microsoft SQL Server 7

Microsoft SQL Server is mainly designed specifically for distributed client/server computing. SQL Server could support databases up to 200MB or 300MB in size. Its scalability allows the same database engine to be used across platforms.

Microsoft SQL Server also includes the features of ease of installation deployment, and use. It includes many tools and features that simplify the ability to install, deploy, manage and use databases. Furthermore, it also has high performance database management and capable of operating efficiently on a small, single-user system with minimal administrative overhead.

In additions, it supports the data warehousing. It includes tools for extracting and analyzing summary data for online analytical processing (OLAP). It also includes tools for visually designing databases and analyzing data using English-based questions.

Finally, it allows the system integration with other server software. For example, SQL Server could integrate with e-mail. The Internet, and Windows.

Table 2.4 Summary of database tools features

Database	Features
Microsoft Access 2000	~ Relational database. ~ Automatically build tables, queries, forms and reports. ~ Enable storage and retrieve data by Visual Basic. ~ Security. ~ Graphical user interface ~ Ease of use.
Microsoft SQL Server 7	~ Client/Server computing. ~ Scalability. ~ High performance database management. ~ Data warehousing. ~ Internet integration. ~ Ease of installation, deployment and use.

2.6.3 Multimedia Tools

1. Macromedia Director 8.5

Macromedia Director is an industry standard authoring tool for multimedia production. It is mainly designed for web application. It combines multimedia elements into portable movie and backs them up with Lingo, which is Director's own interactive scripting language.

Lingo is a powerful scripting language. It enables a Director developer and the movie's audience to control any situation in the production. While adding features to Director that Lingo does not provide, we can obtain or create C modules called Xtras, which could communicate with Director.

Furthermore, Director has a host of media editors to create, modify, import or edit graphics, sounds, text, video, animation and interactivity to deliver the highest quality productions possible. In addition, highly compressed and redistributable Shocked fonts provide great looking fonts cross platform, cross browser, or anywhere.

Besides, its syntax is easy to understand and command like actual English. It also offers an easy use of developing environment similar to standard applications compared to C and Java. This helps developers to program more easily. However, it still required little technique proficiency to develop a project.

2. Macromedia Authorware 6

Authorware 6 is the leading visual rich-media authoring tool for web and online learning. It allows developers, instructional designers and subject matter experts to create engaging, online learning experiences, track student results and deliver consistent rich media training on any platform. Thus, the ideas for programs require heavy and complex interactivity.

Decision icon of Authorware provides built in flow of control functionality. Besides, it also allows using framework and navigating icons such as next, previous, first, last section, therefore program can create easily without any scripting. Furthermore, using of map icon, can divide program into modular sections and this allows easy collaborations.

3. Macromedia Flash 5.0

Flash, lighting fast bookkeeping is what the name stands for. It provides a very simple bookkeeping and all legal documents are printed automatically. As other Macromedia products, Flash has the cross platform facility.

Flash provides familiar user interface, which is based on familiar and intuitive features that exist across the Macromedia product line as well as design products throughout the industry. Thus, it enables designers to create engaging graphics more easily and smoothly with the familiar user interface. It also fuses the precision and flexibility of vector graphics with bitmaps, audio, animation and advanced interactivity to create brilliant and effective program that attract users.

Furthermore, Flash contains vastly improved documentation and learning aids to help new developers. It includes more than 800 pages of comprehensive documentation, online help and built in step-by-step lessons. Graphical user interface also makes development of a product more easily.

Table 2.5 Summary of multimedia software features

Multimedia Software	Features
Macromedia Director 8.5	~ Web application. ~ Authoring tool for multimedia product. ~ Combines multimedia elements into portable movie. ~ Powerful scripting language (Lingo). ~ Cross platform. ~ Broad media and file format support. ~ Syntax easy to understand. ~ Required little technical proficiency to develop a product.
Macromedia Authorware 6	~ Web and online learning application. ~ Suitable for program that required heavy and complex interactivity. ~ Provides built in flow of control functionally. ~ Allows using framework and navigation icons.
Macromedia Flash 5.0	~ Provides simple bookkeeping. ~ Cross platform ~ Create beautiful, compact and resizable animation and graphics. ~ Provides graphical editing tools. ~ Provides familiar user interface. ~ Ease of learning. ~ Ease of use.

2.6.4 Editing Tools

1. NJSTAR CWP 4.31

NJSTAR is a stand-alone Chinese word processor designed to input, edit, format, convert and print Chinese documents in all language versions of Windows 95, 98, NT and 2000. it supports both Simplified and Traditional Chinese characters and is an ideal Chinese word processing tool for users of all language levels, as it is also a great tool for Chinese language teaching/learning. Besides, it also enables convert/switch in between Traditional and Simplified Chinese on the fly with "one to many" artificial intelligence.

NJStar can supports Chinese true type fonts (TTF) and Unicode Rich Text Format (RTF). It allows open, save and copy Chinese RTF files. It also supports Chinese character vertical printing; ability to enter/edit Simplified Chinese, Traditional Chinese and English on the same line.

It consists up to 13,000 BIG5 and 6700 GB of character sets. It has various input methods such as Continuous Pinyin (LianPin), Standard Pinyin, Zhuyin, Cantonese, Five Strokes, Chang Jie, and Radical lookup, etc. Totally more than 20 methods. All the methods have word association (LianXiang).

Furthermore, it consists of a comprehensive two-way Chinese-English dictionary. Chinese to English and English to Chinese two–way fast lookup, with 50000 entries in the dictionary. "Hanzi" Information function could converts a block of Chinese text to "Pinyin" with tone. Bilingual menu could display menu items in English (default), Simplified Chinese or Traditional Chinese.

2. Chinese Star 2.97

Chinese Star is commercial software designed to use in English and Chinese Microsoft Windows. This software allows users to perform Chinese computing in English Microsoft Windows and to basic Chinese culture in Chinese Microsoft Windows. Chinese Star enables us to read and write e-mails, browse through Internet and Intranet in both Chinese and English with our web browsers. Users can choose either GB or BIG5 encoding with one mouse click.

It also allows user to prepare text documents and tables in both Chinese and English using Microsoft Windows text editors such as notepad, Microsoft Word, Microsoft Excel and Microsoft WordPad. Besides, we can also use Chinese fonts in drawing utilities, such as Microsoft PowerPoint, Adobe Photoshop, PaintBrush and Adobe PageMaker.

The Chinese Star text is distinguishably beautiful. Documents and presentations authored in Chinese Star are delightful and tasty. Chinese Star has a complete line of all popular Chinese input methods. These input methods are exceptionally useful. It has user defined and customizable dictionaries, frequently used characters or phrases will come in as your top choices and infrequently used user-defined phrases will be gradually moved to the end of the line. Therefore, it can define entire sentences by a few strokes.

3. Adobe Photoshop 6.0

Photoshop is a powerful tool for digital image enhancement, photo retouching, and image composing. It provides multiple uses of undo and redo, editable text with character-level formatting, flexible and precise color management controls, and built-in support for spot-color channels. These features are totally time saving and increase productivity of task.

Graphical user interface, image window, toolbox, options bar and a set of floating palettes make a task done in easier way. Photoshop also provides integrated tools for creating and outputting crisp, editable vector shapes and text. With these tools, we can incorporate resolution-independent, vector-based graphics and type into pixel-based images to achieve an unparalleled range of design effects.

It also enables us easily combine crisp, resolution-independent type with pixel-based images, and then output sharp type edges with our image to produce high quality results. Besides, it also includes extensive new type formatting controls to help us produce the best-looking text possible. This includes the new type warping that lets us twist and pull type to produce cool effects. Best of all, the type remains directly editable in the image no matter how we manipulate it.

Furthermore, it includes comprehensive optimization features for producing the highest quality graphics with the smallest possible file size. It helps to precisely balance image quality and file size, compare an original image side by side with optimized versions. Its History palette enable us undo and redo multiple editing steps instantly. The History palette tracks and displays a complete list of recent editing steps.

Finally, Photoshop support layer effects, which enable quickly add drop shadows, inner and outer glows, levels and embossing to layers. When applied, these effects remain live, so they update automatically when we edit the layer. We could also use layer effects to create eye-catching text that still editable or to design appealing rollovers, such as buttons that encourage interaction.

Table 2.6 Summary of editing software features

Editing Software	Features
NJSTAR CWP 4.31	~ Stand-alone Chinese word processing. ~ Supports Simplified and Traditional Chinese character. ~ Consist up to 13,000 BIG5 and 6700 GB of characters. ~ Various input methods. ~ Consists two-way Chinese-English Dictionary. ~ Bilingual menu.
Chinese Star 2.97	~ Microsoft Windows Platform. ~ Supports Simplified and Traditional Chinese character. ~ Enable to read and write e-mail in Chinese. ~ Could prepare text documents and tables and provides drawing utilities. ~ Consists of all popular input methods. ~ Consists of user defined and customizable dictionary.
Adobe Photoshop 6.0	~ Powerful tool for editing images, graphics and photos. ~ Integrated with scan function. ~ Provide high quality images and graphics with smallest possible sizes. ~ Multiple levels of undo and redo functions. ~ Flexible and precise color management controls. ~ Resolution independent. ~ Ease of use.

Chapter 3 System Analysis

3.1 Target Group

Computer Aided Learning for Chinese Phonetic is design for primary school's pupil start from standard 1 to standard 6 or somebody who want to learn Chinese Phonetics, even he or she doesn't learn Chinese language before.

Therefore, this system is built in Chinese (Simplified and Traditional Chinese character) and English version, which the user can be in English educational or Chinese educational people.

The lessons contain also include basic pronunciation of vowels, consonants and diphthongs. And also, four different tones for each word also included to let beginner start stepping into the Chinese world.

3.2 Finding From Questionnaires

In order to find out the existing problem of teaching Chinese Phonetics and what they are expected of the system, a survey has conducted. The target population of this survey is teachers form the primary school that have been teaching or are teaching Chinese language now. The population of the survey comprise of 40 teachers.30 of them have been chosen from the ex-teacher which study in University of Malaya now in Faculty of Language. Others are chosen from teachers teaching primary school such as SRJK(C) Pei Chay at Petaling Jaya.

The reason ex-teachers were been chosen because they came from different state in Malaysia and can give different perspectives of opinion about teaching Chinese Phonetic in their school. However the opinion of current teaching teachers also need to consider getting more information about the currently learning situation.

From the survey, I found that 65% of the teachers have 6 years and above teaching Chinese language experience. Just 15% of them have 2 years and below teaching experience. For more details we can look at the chart below:

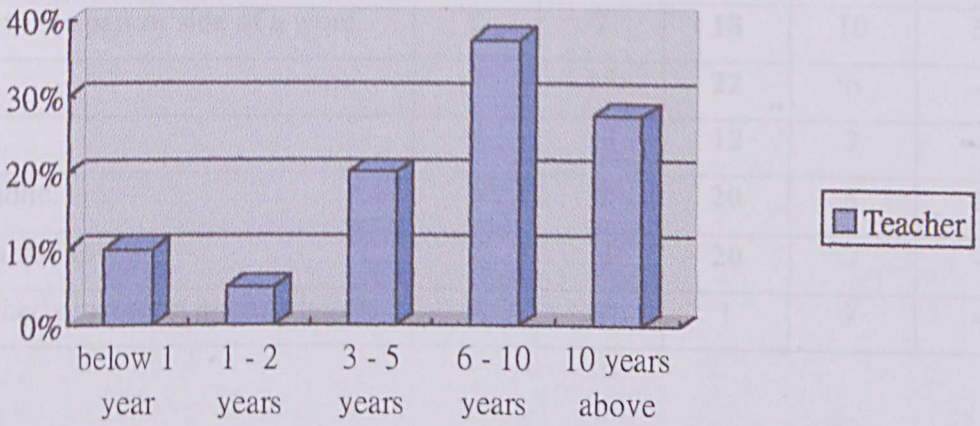

Figure 3.1 Teacher's teaching experience

Furthermore, 92.5% of the schools they came from are conducting computer lessons and most of their pupils (86.5%) are attending the computer lessons.

From the survey result, I also found that there is no serious problem facing by the pupils in learning Chinese Phonetics. The problems are still having but not seriously happen. Some of the problems like:

1. Pupils shy to speak in the public.
2. Pronounce according to the part or side of a word.
3. Unwilling to learn.
4. Cannot remember the correct pronunciation.
5. Cannot concentrate in the lesson.
6. Lack of interest
7. Cannot pronounce correctly.
8. Infect by teacher incorrect pronounce.

Below was the result from the survey about problems facing by the pupils in learning Chinese pronunciation:

Table 3.1 Problem facing by pupils in learning Chinese Phonetics

Problem facing	Not at all → Very Serious				
Cannot remember the correct pronunciation.	-	6	**29**	5	-
Cannot pronounce correctly	-	13	**16**	9	2
Pronounce according to the part or side of a word.	2	7	**18**	10	3
Unwilling to learn.	7	15	**22**	6	-
Lack of interest	4	**17**	12	7	-
Shy to speak in the public.	3	8	**20**	8	1
Cannot concentrate in the lesson.	2	11	**20**	7	-
Others- infect by teacher's incorrect pronunciation.	-	-	1	-	-

Furthermore, I have asked them about the methods used to teach pupils the pronunciation of Chinese words. The results are, most of the teachers prefer method that let students repeatedly listen and pronounce the word. Besides, using learning activities also consider by most of the teachers. Below is the table show the result of teacher's opinions:

Table 3.2 Methods used to teach Chinese Phonetics

Teaching method	Not Effective → Very Effective				
a) Using pictures to present the word.	1	1	**15**	9	14
b) Listen repeatedly to the same word.	-	-	7	**23**	10
c) Repeatedly listen and pronounce the word.	-	-	3	17	**20**
d) Read the Chinese ancient scripture or poem.	-	5	**20**	10	5
e) Learn from educational cartoons.	-	4	16	**17**	3
f) Learn from educational programs.	2	1	12	**16**	9
g) Spelling.	-	1	13	**18**	8
h) Computer educational programs.	1	2	13	**20**	4
i) Quizzes.	-	1	12	**14**	13
j) Learning activities.	-	1	5	**18**	16
h) Others- Radio station.	-	-	-	1	-

Next, I have asked their opinion about the effectiveness using computer programs in teaching Chinese language pronunciation and what features are effective. The teachers said that using animation, cartoons and quizzes are the effective way. Below is the table show the result of how effective are the following methods using in computer:

Table 3.3 Methods used to teach Chinese Phonetics using computer

Teaching method	Not Effective → Very Effective				
a) Using pictures and graphic design.	-	1	7	**17**	15
b) Repeatedly listen and pronounce the word.	-	1	5	**17**	**17**
c) Read the Chinese ancient scripture or poem.	-	4	12	**18**	6
d) Using animation and funny cartoon.	-	-	5	17	**18**
e) Replay the words pronounced by the pupils.	-	-	7	15	**18**
f) Quizzes.	-	1	4	**24**	11
h) Others (Please suggest)	-	-	-	-	-

3.3 Requirement Specification

3.3.1 Functional Requirements

Based on the survey conducted and learning package reviewed, several modules for Computer Aided Learning for Chinese Phonetics are suggested as the following, they are Pinyin pronunciation module, word pronunciation module, exercise and quiz module, game module and performance module.

1. Pinyin Pronunciation module

Pinyin Pronunciation module provides beginning lesson for basic pinyin pronunciation, which is a romanized system for Chinese pronunciation. It displays text, pictures, sounds and animation to help students to learn basic pinyin pronunciation, including vowels, consonants and diphthongs.

Different lessons will use to teach user how to pronounce vowels, consonants and diphthongs. This is because these were the basic elements needed before stepping into next level

2. Word Pronunciation module

Word Pronunciation module contains the intermediate lesson to help students to pronounce a Chinese word. It also used text and sounds in the lesson.

In this module, different lessons will guide user to learn what is vowels, consonants and diphthongs with examples. Also, user will learn to learn how to read pinyin in four different tones.

3. Exercise and Quiz module

Exercise and Quiz module provides exercise to student, which enhance their understanding of the lesson. The exercise and quiz will be implemented in interactive and interesting way to attract user's attention and interest.

A lot of sounds, graphics and animation will be used to make the quiz and exercise more interesting. Besides, the result will be stored in database for Performance module to generate performance chart.

4. Game module

Game module enables students to test their understanding to the lesson and used to get some fun with the phonetics! The purpose of this module is change the image of Chinese Phonetics become interesting and fun. Student must used their knowledge of Chinese Phonetics to play and win the game, if not, they must go through the lesson and exercise first.

As we know, games also need a lot of graphics, sound and animation to implement it and a well-design game can attract user effectively.

5. Performance module

Performance module shows the results in exercise and quizzes done by the login user. It will display the result in table form and graphically such as a chart. The purpose is to let user know how much they have learned starting from they start the lessons.

3.3.2 Non-Functional Requirements

Below are the non-functional requirements for Computer Aided Learning for Chinese Phonetics:

1. Ease of use

The program is easy to use because it is going to have the window capability such as help file, control window button and many more that you are familiar with it. Besides, save function is provided to let user to quickly enter last lesson or section.

2. Availability

It is going to distribute as CD-ROM. With this, user can carry the program everywhere that has computer and multimedia hardware.

3. User Friendly

The use of button, mouse, keyboard and function key will not make the user helplessly.

4. Maintainability and Expandability

As the program is written in modular form, programmer can maintain the existing module to perform more better of expand the module to become more completed.

5. Understandability

The code of the program is written using natural language such as English. Remarks and comments are written so that user is able to understand the code easily.

3.4 Development Tools Analysis

3.4.1 Waterfall Life Cycle Methodology

I choose Waterfall Life Cycle Methodology in developing my project because it represents basic engineering practice specification. I can follow the each stage clearly and go back to previous stage to correct any errors if occur.

3.4.2 Hardware

Listing here is the minimum hardware needed to develop Computer Aided Learning for Chinese Phonetics:

~ IBM compatible computer
~ 36x CD-ROM drive
~ SVGA monitor with 640×480 and 256 colors
~ 2.5 gigabyte hard disk
~ 300×600 dpi scanner
~ 8 bit MPC or compatible sound card
~ Speaker
~ Microphone

3.4.3 Software

Software development tools for Computer Aided Learning for Chinese Phonetics are showing as below:

1. Visual Basic 6.0

Visual Basic is chosen instead of authoring system, because this programming language is easy to use. It also flexible and has large user base with the 3-rd party add-ons.

2. Chinese Star 2.97

Chinese Star 2.97 is a Chinese word processor designed to input, edit, format, convert and print Chinese documents. It supports Simplified and Traditional Chinese characters., Besides, if also consists of various popular input methods. Due to the familiar and ease of use, it is used for preparing the notes of Computer Aided Learning for Chinese Phonetics.

3. Microsoft Access 2000

Microsoft Access 2000 has a lot of powerful features that make the designing of database easier and ease of use. Performance Analyzer is one of the features that enables analyzing of a database and make suggestion to optimize the speed and performance of the database.

Besides, it provides security of the database by using password. Unauthorized person cannot open or modify the database without the password. Furthermore, it is more suitable for stand-alone system compare with Microsoft SQL Server 7.0. Therefore, it is chosen to develop database in this project

4. Macromedia Flash 5.0

Macromedia Flash enables us to create beautiful, compact and resizable animation and graphics. Besides, it can also generate the product into video clip in a smallest size as possible. Furthermore, if does not require any technical skill to

operate it. Thus, it is easy to use and learn. Therefore, it is used to create the exercises and quizzes part of the system in the form of video clip.

5. Adobe Photoshop 6.0

Adobe Photoshop is a powerful tool for digital image enhancement, photo retouching and image composing. It is an advance image processing and creating program. Besides, it also allows image like clipart, scanned photo, video captured image to have its color modified and enhancement. Therefore, it is using to create and edit picture, graphics, images and animation.

6. Microsoft Sound Recorder

To add the multimedia element, sound into the program. This is used to record sound, music and song that relevant to the contents.

7. Microsoft Word 2000

This word processing is used to produce a complete documentation.

3.5 User System Requirements

For the learner or user, the minimum hardware that needed:

~ IBM compatible computer
~ Microsoft Windows 95 or above
~ CD-ROM drive
~ VGA monitor with 640x480 resolution
~ 2.1 gigabyte hard disk
~ CPU 166 MHZ and above
~ 32MB RAM
~ 8 bit MPC or compatible sound card

Chapter 4 System Design

4.1 Architectural Design

It shows the initial design process, which identifies the subsystem and establishing a framework for sub system control and communication.

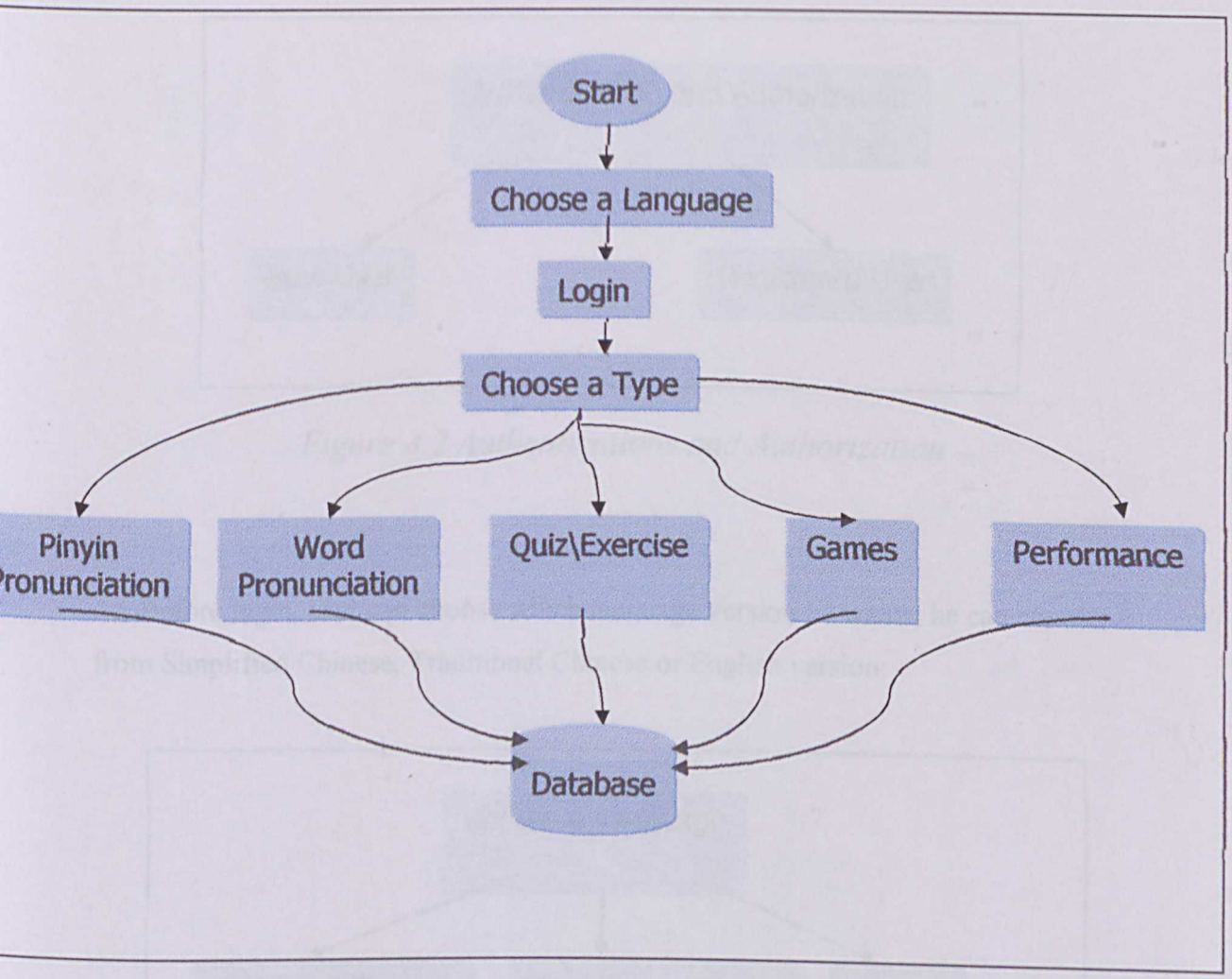

Figure 4.1 System Architectural Designs

As shown in Figure 4.1, the Computer Aided Learning for Chinese Phonetics' architectural design is structured into number of principal sub systems, of which each sub system is an independent software unit. The communication between these sub systems is identified. Then, the identified sub system is decomposed into modules. The type of modules and their interconnection are decided in the initial process. This Modular decomposition will reduce complexity and facilitates.

In this module as shown in Figure 4.2, only two types of user are allowed to login into the program: new user and registered user. For new user, the learner must enter his initial and password sign up as a registered user. While the registered user need to enter login name and password to activate program.

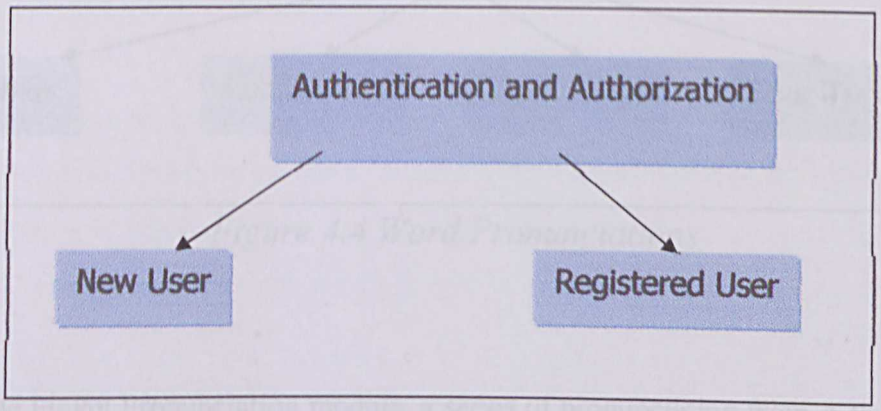

Figure 4.2 Authentications and Authorization

Before login, user can choose which language version he wants, he can choose from Simplified Chinese, Traditional Chinese or English version:

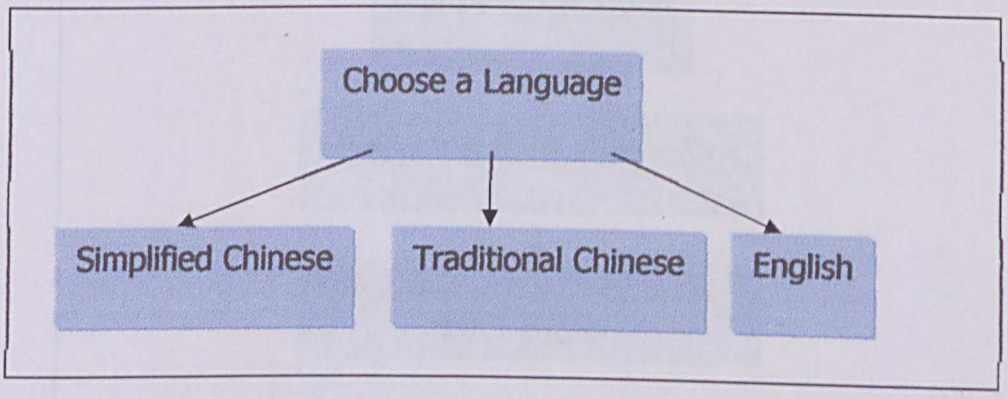

Figure 4.3 Choose a language

In the Word Pronunciation module, user can choose from vowels, consonants, diphthongs or four tones lessons like figure 4.4 below:

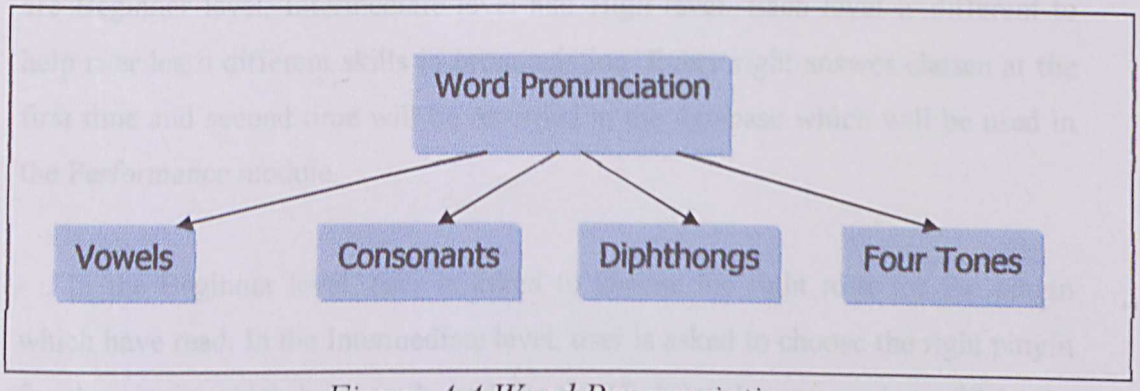

Figure 4.4 Word Pronunciations

In the Pinyin Pronunciation module, a series of pronunciation from A to Z will guide user to learn the pronunciation of every pinyin and four different tones of every pinyin. There are also an example Chinese character for each pinyin and each tone to help user to known what character the pinyin refer to.

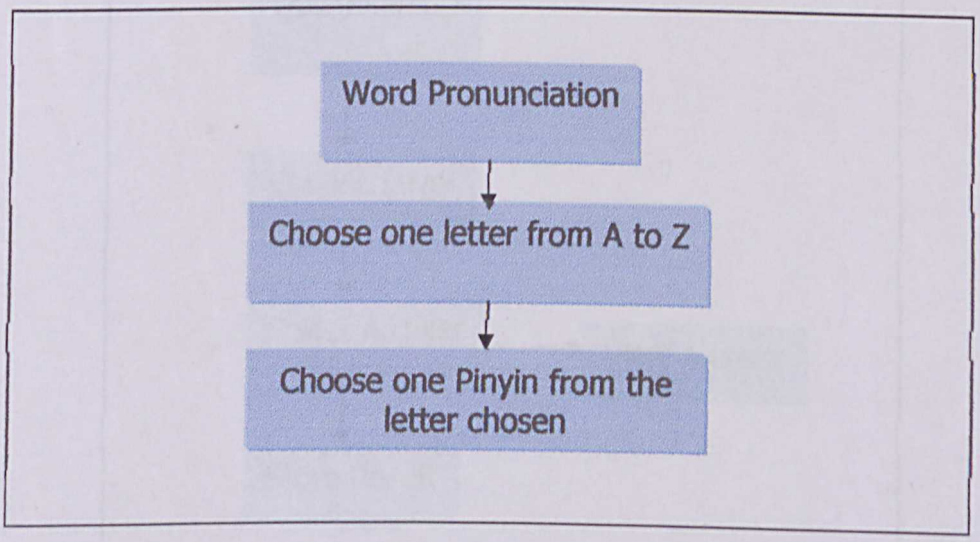

Figure 4.5 Pinyin Pronunciations

In the Exercise or Quiz module, there are three levels choose by the user, there are Beginner level, Intermediate level and High level. Each level is different to help user learn different skills in pronunciation. Every right answer chosen at the first time and second time will be recorded in the database which will be used in the Performance module.

In the Beginner level, user is asked to choose the right tone for the pinyin which have read. In the Intermediate level, user is asked to choose the right pinyin for the pinyin which have read. And for the High level, user needs to fill in the blank and choose the right tone for the pinyin which have read.

In Beginner level and Intermediate lever, if answer chosen was wrong, the wrong answer will be taken out from the selection. In the High level, the answer will be shown if the user has wrong five times continuously.

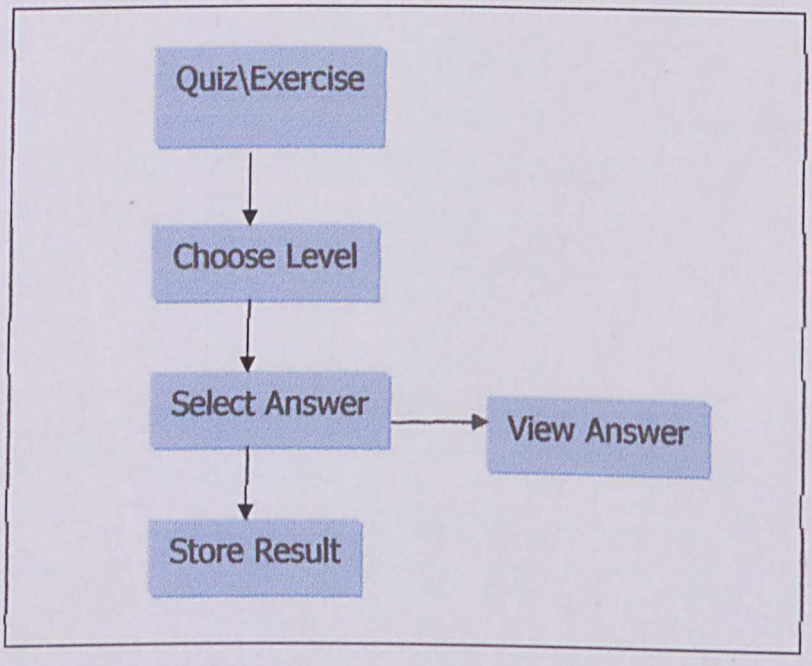

Figure 4.6 Quizzes or Exercises

Performance module allows user to view his performance for quiz and exercise. To analyze the performance through graphical representation, user can click on the button labeled Graph. The process of this module is shown in Figure 4.7:

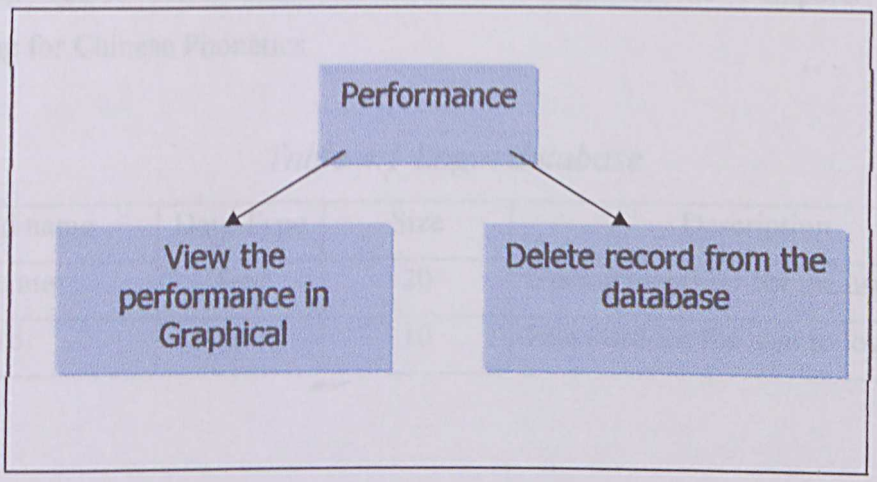

Figure 4.7 Performances

4.2 Database Design

As there is a login function for authorized user, quiz to test user and a lot of sound to read by the program, database design becomes very important here. Firstly, we need to identify the database, then the attributes and data type of the database. Tables below show the database design for the Computer Aided Learning for Chinese Phonetics:

Table 4.1 Login database

Field name	Data Type	Size	Description
Login name	Text	20	Unique identifier for the user name
Password	Text	10	Password for the user to login

Table 4.2 Pinyin database

Field name	Data Type	Size	Description
ID	Integer	4	Identified each Pinyin
Letter	Char	4	Letter of Vowel, consonant or diphthongs
Sound	Text	10	Location of the sound file
Example_Word_1	Text	10	Example word

Table 4.3 Quiz\Exercise database

Field name	Data Type	Size	Description
ID	Integer	4	Identified each question
Letter	Char	10	Letter of Vowel, consonant or diphthongs

Table 4.4 User's performance database

Field name	Data Type	Size	Description
Login Name	Text	20	Unique identifier
Password	Text	10	Password for the user to login
Beginner_First	Number	4	How many times right at the first answer in Beginner level
Beginner_Second	Number	4	How many times right at the second answer in Beginner level
Intermeidate_First	Number	4	How many times right at the first answer in Intermediate level
Intermediate_Second	Number	4	How many times right at the second answer in Intermediate level
High_First	Number	4	How many times right at the first answer in High level.
High_Second	Number	4	How many times right at the second answer in High level.

For the sound file, there will be store in folders that starts from A to Z which the sound files were stored according to its first alphabet of pinyin.

4.3 User Interface Design

Figure below shows the preliminary user interface design for Computer Aided Learning for Chinese Phonetics. Firstly, the authorized user will login into the program. Then, the main menu in figure 4.9 will guide user through the desired option. User needs to choose one from the 6 options. To logout, user just clicks the exit image.

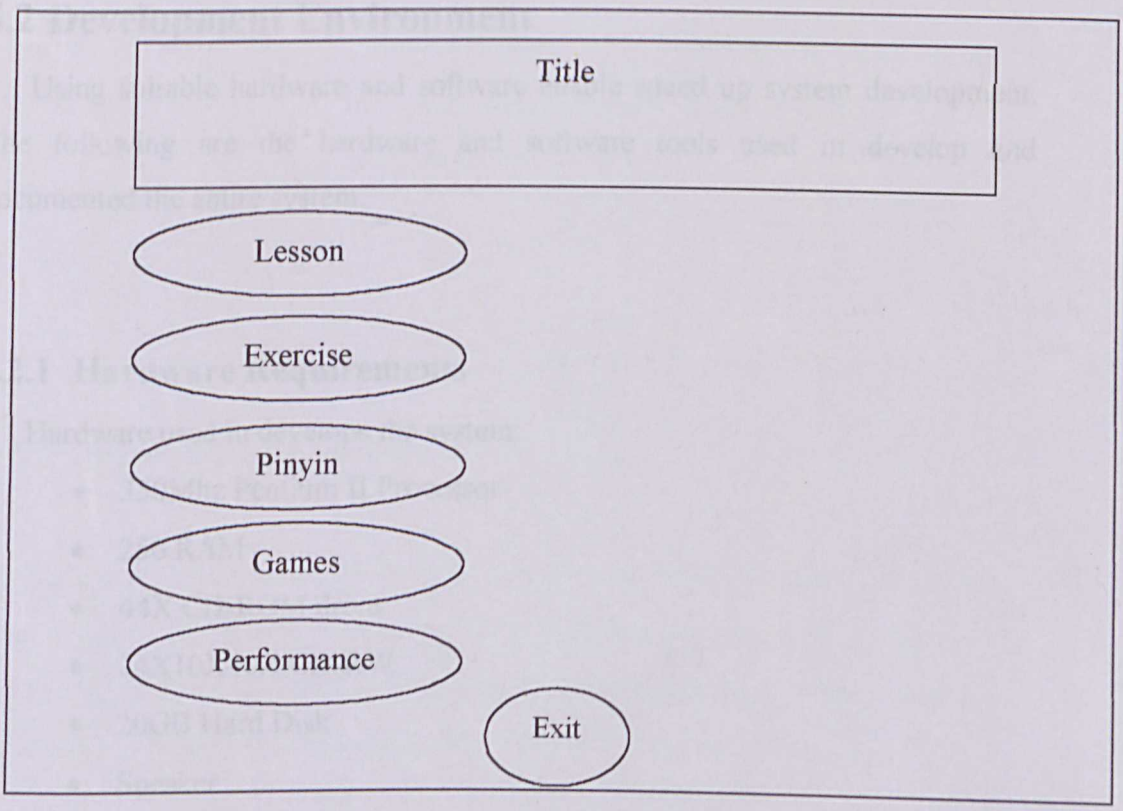

Figure 4.8 Main menu interface

Chapter 5 System Implementation

5.1 Introduction

System implementation is the construction of the system and the delivery of that system into product. System implementation or construction phase includes building and testing of system. It involves the conversion of the system requirements and designs into program coder.

5.2 Development Environment

Using suitable hardware and software enable speed up system development. The following are the hardware and software tools used in develop and documented the entire system.

5.2.1 Hardware Requirements

Hardware used in develops the system:

- 350Mhz Pentium II Processor
- 256 RAM
- 44X CD-ROM drive
- 24X10X40X CD-RW
- 20GB Hard Disk
- Speaker
- Microphone
- Other standard desktop PC components

5.2.2 Software Tools Requirements

Below is a table that lists the software tools used in developing this system.

Table 5.1 Software Tools for Development

Software	Usage	Description
Microsoft Windows 98	System Requirements	Operating System
Microsoft Visual Basic 6.0	System Development	System Coding
Microsoft Access 2000	Database	Build database
Microsoft Word 2000	Documentation	Writing documentation
Microsoft Paint	Contents Design	Chinese Character Design
Adobe Photoshop 6.0	Interface design and contents design	Image design

5.3 Development of System

Microsoft Visual Basic 6.0 (VB6) is a very powerful tool for creates a graphical user interface applications. The system had used some of its features and technology in creating, editing, deploying and managing the system. Visual Basic 6.0 is chosen to develop the system due to the following reasons.

- Easy to learn

  Coding of Visual Basic 6 is as common language. Therefore it is easy to read, write and understand. Thus the learning time of this language is shorter.

- Create windows application

  Visual Basic 6 enables development rapidly creates a windows-based application. Its provides a complete set of building windows objects such as buttons, text boxes, list boxes, scroll bar and the others.

- Support database connectivity

  Visual Basic 6 enable us to access the database built in Microsoft Access 2000. It acts as a front-end tool for user to modify, add, delete and view the contents of the database.

- Timer control

  Visual Basic 6 provides timer control that enable execute code in a regular interval. In this system, timer control is used to create and control shining buttons and labels, show the time in Exercise and Games modules.

Microsoft Paint and Chinese Star 2.97 are used to prepare notes in graphics files. By using this method, the system will able to display all Chinese characters without supporting of any Chinese software.

Besides, Adobe Photoshop 6.0 is used for beatifying the interface which used to edit and draw images.Finally, Microsoft Sounds Recorder is used to record and edit sound used in pronounce pinyin.

Program optimization is a process of improving the efficiency of the system. This system is a graphical user interface application. Thus, the speed for user to judge how well of the system. The following are the approaches used to optimize the program:

- Enhance the execution speed of the program

  Avoid using variant data types, which require additional internal program standards to identify the information being store. Besides, minimize programming initialization when loading a form also make the displaying faster.

- Decrease the memory used to run the program

  Reviewing codes for unused variables, constants and remove them from the program codes. Besides, unload the form when it is not used by the user.

5.4 System Coding

Following are features of the system coding:

- Modular

  System is built module by module. Each module have their own functions. For example, Lessons module will have functions of displaying picture and lessons, go the next lessons, go to previous lessons and pronounce pinyin. Modulation will make the maintenance easier to carry out in the future.

- Independency

  Each function is independently. That is whenever changes are made in one function it will not affected the others function. Therefore, any changes needed on function will be easier and faster.

- Understandable

  Comments of coding or program are written in each function. This will make the coding of the system is easier to understand by others people.

5.5 Testing

The objective of software testing is to uncover errors. To fulfill this objective, a series of test steps are planned and executed. They are unit testing, integrating testing and system testing.

Software testing is a critical element of software quality assurance and represents the ultimate review of specification, design and coding. There are several rules to achieve testing objective as following:

- Testing is a process executing a program with the intent of finding an error.
- A good test case is one that has a high probability of finding and undiscovered error.
- A successful test is one that uncovers a yet undiscovered error.

5.5.1 Unit testing

Unit testing normally considered as an adjunct to the coding step. Unit testing focuses on verification effort on the smallest unit of software component or module. The module interface is tested to ensure that information properly flows into and out of program unit under test. Local data structure is examined to ensure that data stored temporarily maintains its integrity during all steps in algorithm's execution. While boundary conditions are testes to ensure that the modules operate properly of boundaries established to limit or restrict processing. All independent paths through the control structure are exercised to ensure that all statements in a module have been executed at least once. Finally, all errors handling paths are tested.

For this system, unit testing was taken out during coding phase. After the source codes of a module has been developed, reviewed and verified for the correct syntax, unit testing case was designed. The module was tested to ensure that it operates correctly. Any errors found in the module are fixed immediately.

5.5.2 Integration Testing

The purpose of integration testing is to adequately test whether or not the software actually runs as one program. It is a systematic technique for constructing the program structure while at the same time conducting tests to uncover errors associated with interfacing. If interface testing shows that the calling/called structure is compatible, the called module works with a driver and the calling module works with a stub, then, interface testing show that this relationship is true when the two modules are actually pit together and further linked into modules that were similarly tested.

Incremental integration approach is used in this system, which base on "build a little, test a little" basic. Where the program is constructed and tested in small increments, where errors are easier to isolate and correct. All errors will be corrected before proceeding to the next integration.

5.5.3 System Testing

A system test is a series of different tests designed to fully exercise the system to uncover its limitations and measure its capabilities. Although each test has a different purpose, all work to verify that system elements have been properly integrated and perform allocated functions, which meet the specified requirements.

The following steps are used to test the system:

- Function testing

  This is the first step taken in the system testing, which focuses on functionality. Effective function tests have a high probability of detecting a fault. There are come guidelines used by the system for function testing as listed below:

  - Have a high probability of detecting a fault
  - Know the expected actions and outputs
  - Test both valid and invalid inputs.
  - Never modify the system just to make testing easier.
  - Have stepping criteria

- Performance testing

  Performing test are conducted to ensure that the system respond time meets user expectations and does not exceed the specified performance criteria under heavy stress or volume. It is measured against the performance objectives set by user as expressed in the nonfunctional requirements. In this system, speed of responds to the user commands, accuracy of the result, and the accessibility of data are checked against the user's performance proscriptions.

- Acceptance testing

  The purpose of acceptance testing is to enable the users to determine whether the system built is meets their needs and expectations. Thus, three users have been chosen to perform the test. Two of them is standard 5 and the other is form 4 student. They found that the system

is quite attractive, especially the exercise part but stills needs some enhancement on the design of the interfaces.

- Installation testing

  The final testing is installation testing the system at user sites. At the beginning of testing, we configure the system to the user environments. Installation tests require us to work with the user to determine what tests are needed on-site. Regression test may used to verify that the system has been installed and works properly. While the test cases ensure that the system is complete and all necessary files and devices are present. In the system, tests are focus on completeness of the installation system and verification of any functional or non-functional characteristics that may be affected by site conditions.

Chapter 6: Evaluation and Conclusion

6.1 Project Problems and Solutions

There are some problems encountered throughout the development of this system as listed below:

- Choosing software development kits

  There are many software tools to develop Chinese Phonetics system. Each software tools have their own strengths and limitations. Due to lack of knowledge about those software tools, the selections process of choosing suitable software development tools becomes more critical. However, the problem is solved by retrieving information of software tools from Internet and read their features from books. In addition, advice and guidance from course mates and project supervisor also make me to clarify what software tools are suitable to build the system.

- Convert Chinese characters into image format

  There are about 1600 characters needs to convert into image format, so it takes a lot time to do it.

- Convert Simplified Chinese into Traditional Chinese character

  Because there are two Chinese version of system have to implement, I need to convert all simplified character to traditional character, it also takes a lot of time to change it.

- Unfamiliar of Adobe Photoshop

  Due to it is the first time of using Adobe Photoshop, many powerful of its features are undiscovered and causes some problems while using it to edit picture. However, with the guidance of course mates and try and error, finally I manage to handle it to do my work.

- Unfamiliar of Macromedia Flash

  Although Macromedia Flash enables us to create attractive animation, due to the time constraints I only able to learn some basic features of it. In additional, edit of a picture may take lots of time. Therefore, I have decided to make those animations in a simple form using Microsoft Visual Basic 6.0

6.2 System Strengths

The following are strengths of the Chinese Phonetics system:

1. Interesting Exercises.

   The exercises are developed as a game style, which make the exercise more interesting and users more willing to try on it.

2. Voice reading and related Chinese character shown

   This system also provides voice reading for each pinyin and each related character was shown too as example. It helps users to learn and know particular pinyin that they do not know.

3. User friendliness

   Chinese Phonetics system is a graphical user interface application. Buttons are provided to enables users to perform commands. Consistency of the interface and predictable control objects make the learning curves becomes shorter.

4. Attractive interfaces and picture

   Chinese Phonetics system attractive interface to attract the desire of users to use it.

6.3 System Limitations

Chinese Phonetics system is a fully electronic operation learning system. It also has its limitations like the others system. The following are the limitations of this system.

1. Cannot support multi-user environment

   This system is a stand-alone system. It cannot support multi-user environment. All users have to install the system into their computer in order to use it.

2. Cannot record sound pronounce by user

   This system just read the sounds for each pinyin but didn't support record and play function to let user compare the sound user pronounce.

3. Cannot store additional notes

   This system is not allows user to add new words into the database. Therefore, it is limited to store about 1600 words only.

4. Recovery

   This system does not recover the exercise and game section when the system fails or halts. That means users have to redo the quiz or exercise.

6.4 Future Enhancement

The system limitations should be improved and corrected in order to enhance the functionality of the system in the future. The following are some suggestions to add more values to the current version of Chinese Phonetics system:

1. Multi-user environment or network

   Chinese Phonetics system can be modifying to enable network accessing. In this environment, the system is required to be installed in a server. Thus the others computers connecting to the server will be able to access Chinese Phonetics system. This situation is useful and suitable for school.

2. Record and play sounds pronounce by user

   The system can be modifying to record and play sounds pronounce by the user to let user to compare and known how he pronounced.

3. Add notes into database

   In the future, this system will enable to add the others relevant, picture, exercise and lessons into the database. Therefore, the system will be more up to date and helpful.

4. Recovery

   In the future, the system should be able to automatically save the exercise or quiz during execution. So that, the system can recover the exercise or game after the system fails.

5. More interesting and attractive animation

   There are only a few animations in the current system. To make learning process more interesting in the future, each lessons should have its own animation to attract user.

6.5 Conclusion

Chinese Phonetics has been successful in attain its objective of develop a high quality courseware for the students. This system is a user friendly, easily understood and attractive, which make the learning process more efficient. However, some limitation as mention earlier should be enhanced in order to make the system more compatible and powerful in the future.

Develop a multimedia application is a very challenging task. A lot of research, time and effort have been taken in order to make this project successful. Anyway, a lot of valuable knowledge that cannot get through the lecture is gained throughout the development of this project. There are window-based programming techniques, concepts and developing application using Visual Basic, opportunity to explore to others software tools like Adobe Photoshop.

Throughout the project, a lot of experience have been gained, new knowledge has been acquired, improvement in understanding project management and improvement in the communication skill. Finally, this project enables the implementation of the software engineering approach to be implied in the development of the system.

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APPENDICES A ~ Questionnaire Form

小学生如何学习中文发音问卷

Survey on the Teaching of Chinese Language Pronunciation

学校名称
School Name: _____

指示：请☑在格子
Instruction: Please ☑ in the box

1. 请问您当了几年中文教师？
How many years have you been teaching Chinese language?

- ☐ 少于一年 Below 1 year
- ☐ 一至二年 1 ~ 2 years
- ☐ 三至五年 3 ~ 5 years
- ☐ 六至十年 6 ~ 10 years
- ☐ 十年以上 10 years above

2. 请问您现在正在教几年级的学生？
Which year of pupils are you teaching now?

- ☐ 一年级 Standard 1
- ☐ 二年级 Standard 2
- ☐ 三年级 Standard 3
- ☐ 四年级 Standard 4
- ☐ 五年级 Standard 5
- ☐ 六年级 Standard 6

3. 请问这间学校有提供电脑课程吗？
Does the school conduct computer lessons?

- ☐ 有 Yes
- ☐ 没有 No
- ☐

4. 如有，请问有多少巴仙的学生有在上此课程？
If yes, what percentages of the pupils are attending computer lessons?

- ☐ 全部都有 All of them. (100%)
- ☐ 大部份有 Most of them.(>75%)
- ☐ 将近一半 About half of them. (50%)
- ☐ 少过一半 Less than half. (<50%)
- ☐ 没有 None of them. (0%)
- ☐ 不清楚 Not sure.

5. 以下是一些学生在学习中文发音时所面临的一些问题。依您的看法，这些问题发生在学生的严重性有多大？
Listed below are problems that pupils faced in learning Chinese language pronunciation. Please rate the seriousness of each of these problems.

	没有 Not At All				非常严重 Very Serious
a) 常忘记如何正确发音 Cannot remember the correct pronunciation.	1	2	3	4	5
b) 不能正确发音 Cannot pronounce correctly.	1	2	3	4	5
c) 有边读边 Pronounce according to the part or side of a word.	1	2	3	4	5
d) 不想学习 Unwilling to learn.	1	2	3	4	5
e) 没有兴趣 Lack of interest.	1	2	3	4	5
f) 不好意思当众发言 Shy to speak in public.	1	2	3	4	5
g) 不能专注于听课 Cannot concentrate in the lesson.	1	2	3	4	5
h) 其他（请写下） Others (Please specify)_____	1	2	3	4	5

6. 以下是一些中文发音教学方法。依您的看法，这些方法对您的学生有多大的效果？

Listed below are methods used to teach pupils the pronunciation of Chinese words. In your opinion, how effective is each of these methods?

		没有效果 Not Effective				非常有效 Very Effective
a)	图形教学 Using pictures to present the word.	1	2	3	4	5
b)	重复聆听同一字句 Listen repeatedly to the same word.	1	2	3	4	5
c)	重复聆听和练习发音 Repeatedly listen and pronounce the word.	1	2	3	4	5
d)	读颂中国文化经典或诗词 Read the Chinese ancient scripture or poem.	1	2	3	4	5
e)	看教育片 Learn from educational video tapes.	1	2	3	4	5
f)	看教育卡通片 Learn from educational cartoons.	1	2	3	4	5
g)	听写 Spelling.	1	2	3	4	5
h)	电脑教学 Computer educational programs.	1	2	3	4	5
i)	趣味问答 Quizzes.	1	2	3	4	5
j)	趣味活动 Learning activities.	1	2	3	4	5
k)	其他（请写下） Others (Please specify)_____	1	2	3	4	5

7. 如果我们用电脑软体来教育学生，请问以下软体程序中的特色可以对学生有多大的帮助？

If computer programs are used to teach the Chinese language pronunciation, how effective are the following learning methods?

		没有效果 Not Effective				非常有效 Very Effective
a)	图形教学 Using pictures and graphic design.	1	2	3	4	5
b)	让学生重复聆听和练习发音 Listen repeatedly and pronounce the words.	1	2	3	4	5
d)	读颂中国文化经典或诗词 Read the Chinese ancient scripture or poem.	1	2	3	4	5
e)	动图和趣味卡通 Using animation and funny cartoon.	1	2	3	4	5
f)	可以重播学生录下的发音 Replay the words pronounced by the pupils.	1	2	3	4	5
g)	趣味问答 Quizzes.	1	2	3	4	5
h)	其他（请写下） Others (Please suggest)_____	1	2	3	4	5

APPENDICES B ~ User Manual

User Manual Table of Content

User Manual Lists of Figures

A. Installation

1. Run the setup.exe to install the program.
2. **REMEMBER TO COPY THE PINYIN (OR CTPINYIN) FOLDER AND SOUNDS FOLDER INTO THE SAME DIRECTORY!**

B. Uninstallation

1. Uninstall from the Add/Remove in the control panel
2. Need to manually uninstall the sounds files and the folder.

C. Login Section

1. Figure 1 is the login interface of the program.
2. If you are first time use it, click the "I am new student" label and enter your name (not more than 50 letters) and password (not more than 10 letters).
3. If you already registered, just enter your name and password.

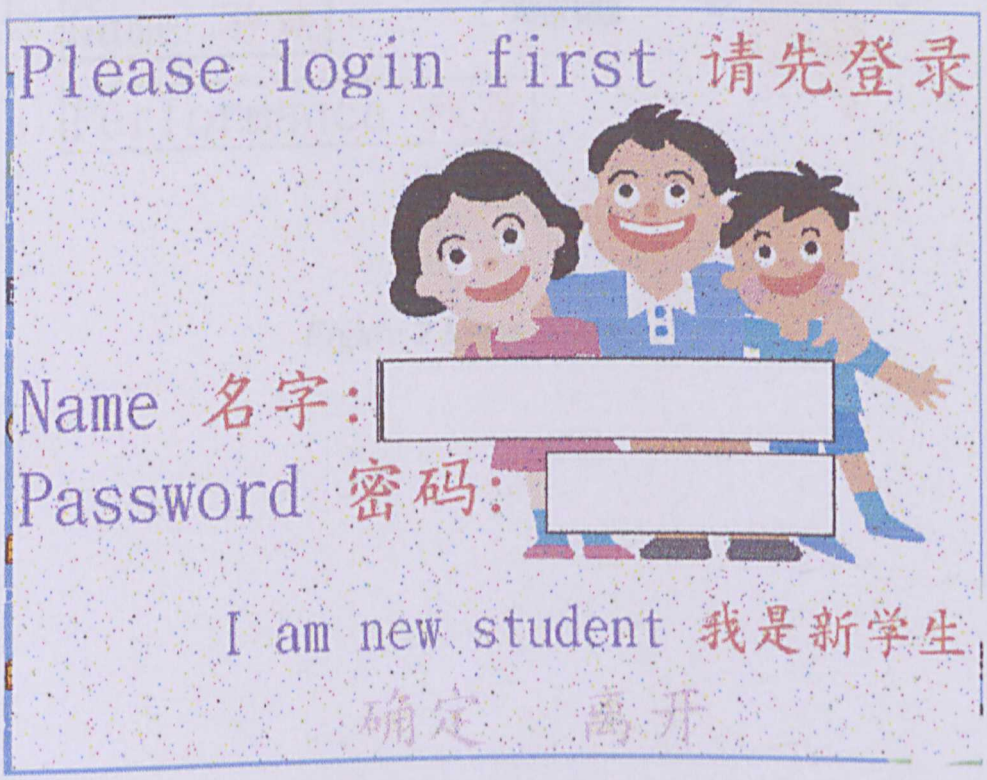

Figure 1 Login Interface

D. Main Section

1. Figure 2 is the first Interface of the program.
2. Click on the button to access different section.
3. Click exit button to exit the program.

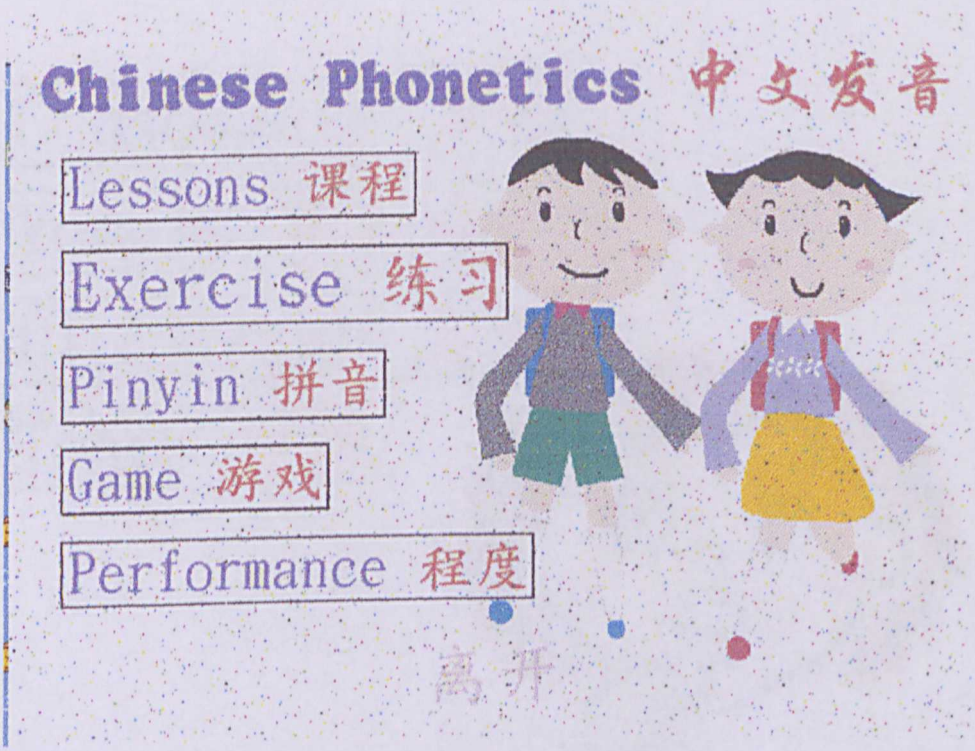

Figure 2 Main Interface

E. Lessons Section

1. Figure 3 is the Lessons interface in the program.
2. Choose any lessons by clicking the button on the interface
3. Click exit button to exit the section.

Figure 3 Lessons Interface

F. Exercise Section

1. Figure 4 is the Exercise interface of the program.
2. Click on the button to access different level.
3. Click exit button to exit the section.

Figure 4 Exercise Interface

4. In the **Beginner** level, click the right tone for the pinyin has read.
5. In the **Intermediate** level, click the right pinyin for the pinyin has read.
6. In the **High** level, enter the pinyin and choose the right tone for the pinyin has read.
7. In those levels, user can click the repeat button to let system to read again the pinyin.
8. User can exit the section anytime by clicking the exit button.

G. Pinyin Section

1. Figure 5 is the Pinyin interface of the program.
2. Click on any letter to choose pinyin which start with the chosen letter.
3. Click exit button to exit the section.

Figure 5 Pinyin Interface

H. Game Section

1. Figure 6 is the Game interface of the program.
2. User needs to find all cards which match in pair in 60 seconds.
3. One card will consists of the sound of pinyin and another card will consists the pinyin.
4. Click exit button to exit the section.

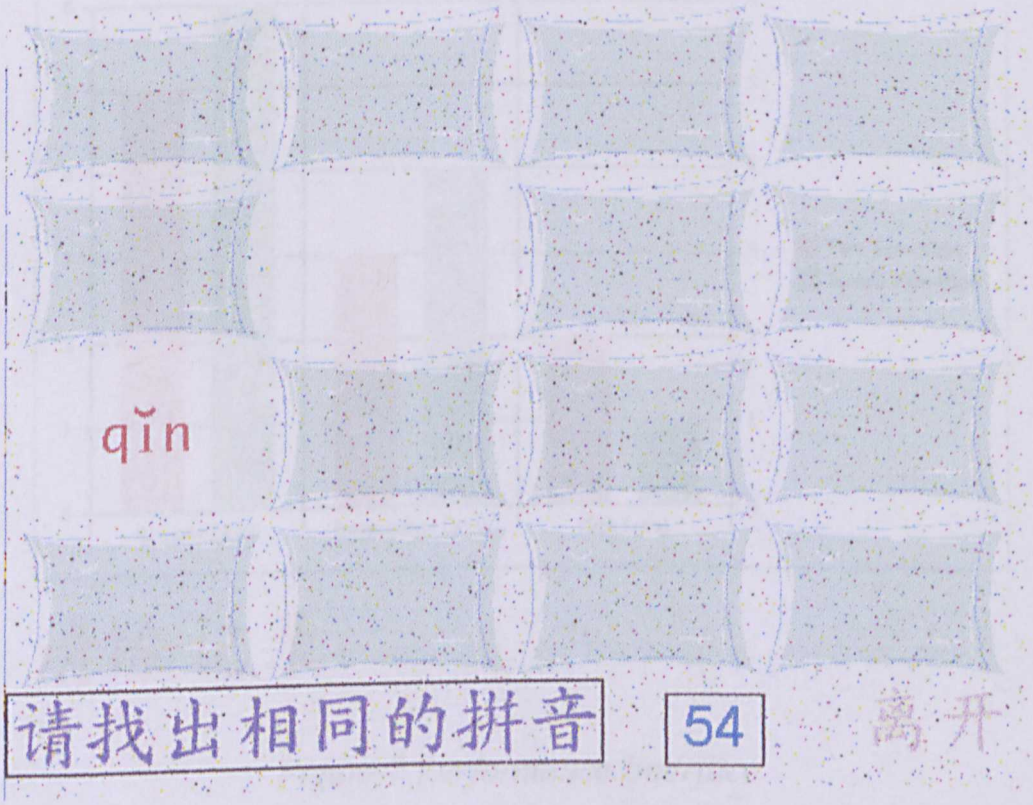

Figure 6 Game Interface

I. Performance Section

1. Figure 7 is the Performance interface of the program.
2. User can see their performance done in the exercise here.
3. User can delete the record by click the "delete record" label.
4. Click exit button to exit the section.

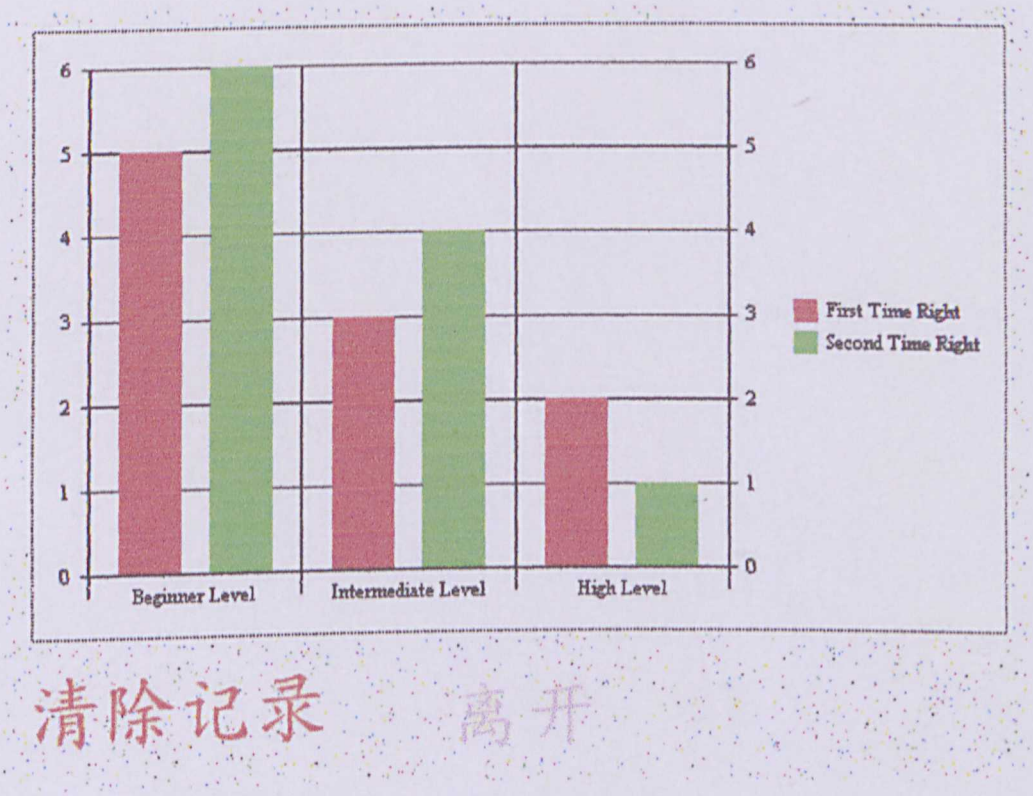

Figure 7 Performance Interface